CURRENT LITERATURE

BOOK REVIEWS

Temperature and life processes

KANITZ[1] has written a monograph containing a critical discussion of the effect of temperature on life processes. He has brought together the literature from the fields of physical chemistry, physiology, pharmacology, bacteriology, botany, and zoology. The reader will find 363 citations of literature. Consideration is given first to the effect of temperature upon the rate of chemical processes. It is found that in general the latter follow the Van't Hoff law, that is, the rate at ordinary temperatures is approximately doubled or trebled for each increase of 10° C. in temperature. The coefficient for 10° C. rise in temperature (Q_{10}) is then 2 to 3. The formulae of BERTHELOT, ARRHENIUS, VON ESSEN, and VAN'T HOFF are derived and the relationships discussed. From these data equations are deduced by which the value of Q_{10} may be calculated from experimental results at any two temperatures. For this purpose either one of the two following equations may be used:

$$Q_{10}=10^{\frac{10\,(\log k_2-\log k_1)}{t_2-t_1}}$$

$$\text{or}\quad Q_{10}=\left(\frac{k_2}{k_1}\right)^{\frac{10}{t_2-t_1}},$$

in which k_2 = rate observed at temperature t_2, and k_1 = rate observed at temperature t_1. While most chemical processes are in agreement with the Van't Hoff law, abnormal values of Q_{10} are found in certain types of reactions. High values of Q_{10} are common in monomolecular reactions, for example, in the inversion of cane sugar, Q_{10} = 5 to 6. Low values of Q_{10} are formed in heterogeneous system where two processes take part, one process slowing down the total rate, for example, when a process is conditioned by diffusion rate, Q_{10} = 1.5 to 1.2. In photochemical processes Q_{10}, with few exceptions, is not higher than 1.4, usually only 1.2 or even 1.0.

Many processes in living organisms show a temperature coefficient approximately that of the Van't Hoff law, within certain temperature limits. Among the plant processes for which this has been found to be the case the following may be mentioned: CO_2 assimilation (MATTHAEI) between 0° and 37° C.; respiration of seedlings (KUIJPER) between 0° and 35° C.; geotropic presentation time (RUTGERS) between 5° and 25° C.; phototropic presentation time

[1] KANITZ, ARISTIDES, Temperatur und Lebensvorgänge. 8vo. pp. ix+175. *figs. 11.* Berlin: Gebrüder Borntraeger. 1915.

(M. S. DE VRIES) between 5° and 25° C.; protoplasmic streaming in *Elodea* (VELTON) between 2°5 and 35° C.; permeability of plant cells and tissues (RYSSELBERGHE) between 0° and 30° C.; intake of water by barley grains (BROWN and WORLEY) between 3°8 and 34°6 C., etc. Among the processes in animals showing a Van't Hoff temperature coefficient are the following: heart beat frequency, pulsation of medusae, rhythmic muscular contraction, peristaltic movement of cat intestine, rhythm in frog stomach, breath frequency, propagation of nervous stimulus, latent time of muscle, rate of cell division in *Paramecium*, generation period of certain bacteria, pupation period, rate of oxygen consumption, etc.

Some high values of Q_{10} are found, especially in relation to life duration and coagulation effects of temperature. Thus, in life duration of sea urchin eggs, $Q_{10}=240$ to 1450; of *Tubularia crocea*, $Q_{10}=485$ to 3900; of barley grains, $Q_{10}=10$ to 16; of spores of certain bacteria, $Q_{10}=8$, 15, 30, 50, or even 320. In denaturing haemoglobin, $Q_{10}=14$; and in precipitation of egg white, $Q_{10}=635$. Some processes that give normal values of Q_{10} within a certain temperature interval show high values of Q_{10} at the lower or critical temperatures. Thus, in CO_2 assimilation, $Q_{10}=28.7$ from $-6°$ to 0° C.; in heart frequency, $Q_{10}=13.7$ from 3°2 to 8°4; in geotropic presentation time, $Q_{10}=20$ from 0° to 5°; in protoplasmic streaming in *Vallisneria*, $Q_{10}=14.7$ from 1°25 to 3°75.

KANITZ brings out more clearly the relation of temperature to life processes by recalculating Q_{10} at the various temperature intervals, instead of indicating only the average coefficient for a long temperature range. When this is done, it is found that in many cases Q_{10} is not a constant at all intervals of temperature. Many processes show falling values of Q_{10} at higher temperatures, for example, CO_2 assimilation, respiration of seedlings, permeability of plant cells, etc. Some processes, however, show a temperature interval at which Q_{10} is constant. In general, in plants the range of temperature within which Q_{10} may be constant begins at 5° C. and ends at approximately 25° C. The rapidity of division of *B. coli* shows two temperature regions with constant coefficients, but with different coefficient values. Investigators should follow KANITZ in this regard, and should calculate Q_{10} for each temperature interval for which data are available.—F. E. DENNY.

Heredity and environment

One of the notable recent books in the general field of genetics is that of CONKLIN,[2] which is a series of lectures delivered at Northwestern University on the "Norman W. Harris Foundation." The author has been unusually successful in maintaining a clear and popular style without any appreciable sacrifice of scientific values. The book departs from the usual type of textbook in genetics in several respects. In the first place, great emphasis is placed

[2] CONKLIN, E. G., Heredity and environment in the development of men. 8vo. pp. xiv+533. Princeton University Press. 1915.